Table 1. Mean (± standard deviation) pH, total alkalinity, and macronutrients of geotextile leachate collected from geotextile bag and used in ebb and flow system.

	Leachate
pH	8.1 ± 0.1
Total alkalinity ($mg \cdot L^{-1}$ as $CaCO_3$)	880.0 ± 10.0
Macronutrients ($mg \cdot L^{-1}$)	
Total ammonia-nitrogen	60.1 ± 14.1
Nitrate-nitrogen	24.0 ± 17.8
Phosphorus (as PO_4^{-3})	29.9 ± 10.2
Calcium	185.0 ± 32.4
Magnesium	80.7 ± 21.7

Table 2. Pak choi growth response to geotextile bag leachate dewatering aquaculture effluent 18 days after planting in the ebb and flow system.

	SPAD	Height (cm)	Growth index (cm)	Shoot dry wt. (g)	Root dry wt. (g)	Shoot:root ratio
Dwarf						
Standard	41.0b	13.9a	20.0a	5.5a	1.4a	4.0a
Small	47.4a	12.6a	18.8a	5.0a	1.3a	3.9a
Standard						
Green	37.7a	15.1b	21.5b	6.4a	1.5a	4.4a
White	42.1a	17.6a	24.8a	6.8a	1.7a	4.2a

Mean separation within varieties in the same column followed by a different letter are significantly different by t-test at $P \leq 0.05$.

Table 3. Macronutrient and micronutrient concentrations of dwarf and standard pak choi plant tissue 18 days after planting in the ebb and flow system supplied with leachate from geotextile bag.

	Dwarf		Standard		
	Standard	Small	Green	White	Sufficient[a]
Macronutrients (%)					
Nitrogen[b]	3.1a	3.2a	3.0a	2.8a	2.39-5.51
Phosphorus	0.3b	0.4a	0.4a	0.3a	0.36-0.80
Potassium	6.2a	4.8b	6.2a	5.4a	2.86-5.74
Calcium	2.5a	2.3a	1.7a	2.2a	1.29-3.21
Magnesium	0.5a	0.6a	0.4a	0.5a	0.19-0.35
Sulfur	0.9a	0.8a	0.8a	0.8a	0.41-0.77
Micronutrients ($mg \cdot L^{-1}$)					
Boron	62.4a	64.5a	59.3a	53.0a	19-39
Manganese	162.7a	183.3a	163.0a	233.0a	85-363
Iron	228.1a	455.0a	131.6a	170.3a	35-52
Copper	5.2a	6.2a	4.5a	4.7a	–
Zinc	25.6b	33.3a	30.7a	28.4a	–

[a]Uchida 2000

[b]For each variety, means within row separated by different letters are significantly ($P \leq 0.05$) different with t- test.

Table 4. Pak choi growth response to inorganic fertilizer or geotextile bag leachate 16 days after planting.

	SPAD	Height (cm)	Growth index (cm)	Shoot dry wt. (g)
Dwarf				
Fertilizer	43.5a	9.4a	15.6a	2.3a
Leachate	27.0b	7.7b	14.3a	1.3b
Standard				
Fertilizer	41.0a	12.8a	22.2a	4.2a
Leachate	22.6b	8.2b	17.8b	1.8b

Mean separation within varieties in the same column followed by a different letter are significantly different by t-test at $P \leq 0.05$.

Table 5. Mean (± standard deviation) pH, total alkalinity, and macronutrients of geotextile leachate collected from geotextile bag dewatering effluent from tilapia farm in Browns, Alabama.

	Leachate
pH	7.9 ± 0.1
Total alkalinity ($mg \cdot L^{-1}$ as $CaCO_3$)	305.0 ± 35.4
Macronutrients ($mg \cdot L^{-1}$)	
Total ammonia-nitrogen	15.4 ± 4.5
Nitrate-nitrogen	11.3 ± 8.1
Potassium	29.0 ± 7.1
Phosphorus (as PO_4^{-3})	62.3 ± 43.8
Calcium	70.0 ± 28.2
Magnesium	25.0 ± 21.2

Table 6. Physical properties [a] of Fafard 3B mix (F3B) and F3B amended with different amounts (v/v) of dewatered aquaculture effluent (AE) in the first and second experiments.

Substrate	Total porosity (%)	Container capacity (%)	Air space (%)	Bulk density ($g \cdot cm^{-3}$)
		Experiment 1		
100% F3B[b]	82.7	65.2	17.5	0.15
25% AE	82.3^{NS}	68.5^{NS}	13.8^{NS}	0.23***
50% AE	77.5*	69.7^{NS}	7.8**	0.27***
75% AE	78.2*	67.2^{NS}	11.0**	0.29***
		Experiment 2		
100 % F3B[b]	80.1	65.4	14.7	0.15
5% AE	79.2^{NS}	62.1^{NS}	17.2^{NS}	0.17**
10% AE	77.2*	63.3^{NS}	13.9^{NS}	0.18***
15% AE	82.5^{NS}	65.3^{NS}	17.3^{NS}	0.19***
20% AE	79.8^{NS}	65.0^{NS}	14.9^{NS}	0.20***

^{NS,} *,**,*** not significant, or different from control at 0.05, 0.01, or 0.001, respectively, Dunnett's two tailed t-test; n=3.

[a] Physical properties determined using methods described by Bilderback et al. (1982).

[b] Control.

Table 7. Particle size distribution for Fafard 3B mix (F3B) and F3B amended with different amounts (v/v) of dewatered aquaculture effluent (AE) expressed as percent weight of sample in each texture group for Experiments 1 and 2.[a]

Substrate	Coarse[b]	Medium	Fine
		Experiment 1	
100% F3B[c]	28.3	31.1	40.6
25% AE	13.0***	41.0**	46.0[NS]
50% AE	8.4***	48.2***	43.4[NS]
75% AE	3.4***	50.5***	46.1[NS]
		Experiment 2	
100% F3B[c]	23.7	33.4	43.0
5% AE	19.3*	37.6**	43.1[NS]
10% AE	17.2*	42.7***	40.1[NS]
15% AE	14.4***	44.1***	41.6[NS]
20% AE	12.1***	44.4***	43.5[NS]

[NS,] *,**,*** are not significant or different from control at 0.05, 0.01, or 0.001, respectively, Dunnett's two tailed t-test; n = 3.

[a] Fafard 3B (Conrad Fafard, Inc., Agawam, MA); dewatered effluent from freshwater nile tilapia production system.

[b]Coarse>3.35 mm; Medium ≥1.00 mm and ≤3.35 mm; Fine <1.00 mm

[c] Control.

Table 8. Chemical properties from composite sample of Fafard 3B mix (F3B) and dewatered aquaculture effluent (AE) used as soilless substrates in Experiments 1 and 2.[a]

	Parameter[b]													
	pH	EC	NH_4-N	NO_3-N	Ca	Mg	P	K	S	Na	B	Fe	Mn	Zn
Experiment 1 Substrate														
F3B	6.1	1.0	15.6	21.3	43.6	41.4	8.9	103.9	102.4	15.7	0.12	0.77	0.14	0.46
AE	6.8	1.8	85.0	1.4	49.4	36.7	36.5	156.8	104.5	56.3	0.21	0.70	0.16	0.67
Experiment 2 Substrate														
F3B	5.9	1.0	< 0.5	29.4	49.6	48.9	3.1	91.0	89.4	14.1	0.13	0.99	0.27	0.43
AE	6.4	2.3	125.4	1.1	75.2	45.0	62.0	185.1	108.9	78.5	0.26	1.01	0.31	0.87

[a] Fafard 3B (Conrad Fafard, Inc., Agawam, MA); dewatered effluent from freshwater nile tilapia production system.

[b] Electrical conductivity (EC), 1 $mS \cdot cm^{-3}$ = 1 $mmho \cdot cm^{-1}$; macronutrients and micronutrients reported as $mg \cdot L^{-1}$,1 $mg \cdot L^{-1}$ = 1 ppm.

Table 9. Container leachate pH and electrical conductivity (EC) for Fafard 3B mix (F3B) and F3B amended with different amounts (v/v) of dewatered aquaculture effluent (AE) 3, 8, and 13 days after planting (DAP) in the first experiment and 3, 10, and 17 DAP in the second experiment.[a]

		pH			EC ($mS \cdot cm^{-1}$)		
Experiment 1	Substrate	3 DAP	8 DAP	13 DAP	3 DAP	8 DAP	13 DAP
	100% F3B[b]	6.0	6.2	5.9	1.8	0.5	0.6
	25% AE	7.8***	7.6***	7.2***	2.5*	1.7***	2.5***
	50% AE	8.2***	7.8***	7.6***	3.9***	2.5***	3.1***
	75% AE	8.4***	7.8***	7.6***	5.0***	4.7***	4.7***
Experiment 2		3 DAP	10 DAP	17 DAP	3 DAP	10 DAP	17 DAP
	100% F3B[c]	5.9	5.9	6.3	1.8	0.8	0.4
	5% AE	6.9***	6.2*	6.6**	1.8ns	2.4***	1.1ns
	10% AE	7.4***	6.8***	6.4ns	3.0***	3.2***	2.1***
	15% AE	7.7***	7.0***	6.7***	3.5***	3.0***	2.3***
	20% AE	7.7***	7.8***	7.3***	5.7***	4.1***	2.7***

[a]Fafard 3B (Conrad Fafard, Inc., Agawam, MA); dewatered effluent from freshwater nile tilapia production system.
[b]Control
ns,*,**,*** are not significantly different or significantly different from the control at 0.05, 0.01, or 0.001, respectively; Dunnett's two tailed t-test; Exp. 1 and Exp. 2, n = 5.

Table 10. Tomato seedling plant height, leaf area (LA), leaf dry matter (LDM), stem dry matter (SDM), and total dry matter (TDM) measured 14 and 21 days after potting in the first and second experiment, respectively.

	Plant height (cm)	LA (cm^2)	LDM (mg)	SDM (mg)	TDM (mg)[a]
			Experiment 1		
Substrate[b]					
100% F3B[c]	7.6	75.2	204.6	38.3	253.6
25% AE	5.4***	37.9***	92.2***	18.1***	120.6***
50% AE	2.3***	5.7***	13.0***	2.8***	21.6***
75% AE	2.0***	2.9***	6.8***	2.4***	14.2***
			Experiment 2		
100% F3B[c]	12.5	108.1	440.3	149.9	603.9
5% AE	15.8***	242.6***	822.4***	263.0***	1,102.2***
10% AE	15.3***	170.9***	410.1[NS]	146.5[NS]	570.6[NS]
15% AE	14.7**	158.9**	391.3[NS]	140.8[NS]	547.6[NS]
20% AE	11.3[NS]	63.5**	121.8***	56.6***	186.1***

[NS],*,**,*** are non-significant or significantly different from the control at 0.05, 0.01, or 0.001, respectively; Dunnett's two tailed t-test.

[a] Includes cotyledons.

[b] Substrates were: F3B = Fafard 3B mix (Conrad Fafard, Inc., Agawam, MA); dewatered effluent from freshwater nile tilapia production system.

[c] Control.

Table 11. The pH and electrical conductivity (EC) of Fafard 3B (F3B) and F3B amended with different amounts of dewatered aquaculture effluent (AE) 0 and 25 days after potting (DAP) along with plant height 26 DAP.[a,b]

Main Effect	pH		EC ($mS \cdot cm^{-1}$)		Height
	0 DAP[c]	25 DAP	0 DAP	25 DAP	26 DAP
Substrate					
100% F3B	6.2c	6.8b	1.7d	0.3c	13.4a
10% AE	7.1a	6.5c	4.7c	0.7c	14.7a
25% AE	7.1a	6.7b	8.2b	2.1b	11.6b
50% AE	6.9b	7.5a	10.1a	3.4a	10.7b
Water					
Municipal	—	6.9a	—	1.3b	12.6a
Fertilizer	—	6.8b	—	1.9a	12.5a
Significance					
Substrate	***	***	***	***	***
Water	—	***	—	***	NS
Substrate and Water	—	***	—	NS	NS

[a] Fafard 3B (Conrad Fafard, Inc., Agawam, MA).

[b] pH and electrical conductivity (EC) of solution obtained by the Virginia Tech pour-thru method; 1 $mS \cdot cm^{-1}$ = 1 mmho/cm.

[c] Mean separation of main effects within the same column followed by a different letter are significantly different by Tukey's test at $P \leq 0.05$.

Table 12. Effect of substrate and water interaction on pepper plant leaf dry matter, stem dry matter, total dry matter, and leaf greenness 26 d after potting in Fafard 3B (F3B) and F3B amended with different amounts of dewatered aquaculture effluent (AE).[a]

	Leaf dry matter (mg)		Stem dry matter (mg)		Total dry matter (mg)		Leaf greenness[b]	
Water Source[c]	Fertilizer[d]	Municipal	Fertilizer	Municipal	Fertilizer	Municipal	Fertilizer	Municipal
Substrate								
100% F3B[e]	0.9 Aa	0.3 Bb	0.2 Aa	0.1 Bb	1.1 Aa	0.4 Bb	57.6 Aa	44.3 Bb
10% AE	0.8 Aa	0.8 Aa	0.2 Aa	0.2 Aa	1.0 Aa	1.0 Aa	51.3 Ab	48.9 Aa
25% AE	0.4 Ab	0.4 Ab	0.1 Ab	0.1 Ab	0.5 Ab	0.5 Ab	46.1 Ac	45.1 Ab
50% AE	0.2 Ac	0.2 Ab	0.1 Ab	0.1 Ab	0.3 Ac	0.3 Ab	46.7 Ac	45.0 Ab
Significance[f]								
Substrate	***		***		***		***	
Water	*		NS		NS		***	
Substrate and Water	***		*		***		***	

[a] Fafard 3B (Conrad Fafard, Inc., Agawam, MA); aquaculture effluent from freshwater nile tilapia production system.

[b] Leaf greenness of four recently mature leaves per plant was quantified with a chlorophyll meter (SPAD–502; Minolta Camera Company, Ramsey, NJ).

[c] Fertilizer = 20N–4.4P–16.6K; Municipal = Auburn, AL city water.

[d] For each parameter values within column followed by different lower-case letters are significantly different for pairwise comparisons of substrate within each level combination of water by Bonferroni adjusted α-level ($P \leq 0.05$).

[e] For each parameter values within row followed by different upper-case letters are significantly different for pairwise comparisons of water within each level combination of substrate by Bonferroni adjusted α-level ($P \leq 0.05$).

[f] NS = Nonsignificant; $P \leq 0.05$ (*), 0.01 (**), or 0.001 (***) based on two–way analyses of variance.

Table 13. The pH and electrical conductivity (EC) of Fafard 3B (F3B) and F3B amended with different volumes of dewatered aquaculture effluent (AE) 0 and 15 days after pottingg (DAP) and leaf greenness of pak choi 16 DAP.[a,b]

Main Effect	pH[c]		EC ($mS \cdot cm^{-1}$)		SPAD[d]
	0 DAP	15 DAP	0 DAP	15 DAP	16 DAP
Substrate					
100% F3B	6.2c	7.1ab	1.7d	0.1c	42.6c
10% AE	7.1a	7.2a	4.7c	0.4c	46.0b
25% AE	7.1a	6.7c	8.2b	1.9b	51.4a
50% AE	6.9b	7.0b	10.1a	5.1a	52.3a
Water					
Municipal	—	6.9b	—	1.9a	48.6a
Fertilizer	—	7.0a	—	1.8a	47.6a
Significance					
Substrate	***	***	***	***	***
Water	—	*	—	NS	NS
Substrate and Water	—	NS	—	NS	NS

[a]Fafard 3B (Conrad Fafard, Inc., Agawam, MA).

[b]pH and electrical conductivity (EC) of solution 16 and 36 d after planting obtained by the pour-through method; 1 $mS \cdot cm^{-1}$ = 1 mmho/cm.

[c]Mean separation of main effects within the same column followed by a different letter are significantly different by Tukey's test at $P \leq 0.05$ (*), 0.01 (**), or 0.001 (***); NS = Nonsignificant.

[d]Leaf greenness of three recently mature leaves per plant was quantified with a chlorophyll meter (SPAD–502; Minolta Camera Company, Ramsey, NJ).

Table 14. Plant height, growth index, and total dry matter of pak choi 16 days after potting in Fafard 3B (F3B) and F3B amended with different volumes of dewatered aquaculture effluent (AE).[a]

	Height (cm)	Growth Index (cm)	Total dry matter (g)
Main Effect			
Substrate			
100% F3B	14.6ab	17.1b	1.8b
10% AE	16.9a	21.6a	4.7a
25% AE	13.9b	21.0a	4.4a
50% AE	10.9c	15.0b	1.9b
Water			
Fertilizer	14.1a	19.2a	3.5a
Municipal	14.0a	18.1a	2.9b
Significance[b]			
Substrate	***	***	***
Water	NS	NS	**
Substrate and Water	NS	NS	NS

[a] Fafard 3B (Conrad Fafard, Inc., Agawam, MA); dewatered aquaculture effluent from nile tilapia production system

[b]Mean separation of main effects within the same column followed by a different letter are significantly different by Tukey's test at $P \leq 0.05$.